

UNITED STATES OF AMERICA
BEFORE THE
DEPARTMENT OF ENERGY
Interstate Electric Transmission System
Electric Reliability Issues
Notice of Inquiry

COMMENTS OF DR MARIJA ILIC, Massachusetts Institute of Technology and the
National Science Foundation

Dr Marija Ilic submits its comments
in response to the Notice of Inquiry on Electric Reliability Issues for the Interstate
Electric Transmission System, issued by the Department of Energy (“Department” or
“DOE”) on November 15, 2000. ¹ In that Notice of Inquiry, the Department seeks
comment on whether it should initiate a rulemaking, pursuant to section 403 of the DOE
Organization Act, for final action by the Federal Energy Regulatory Commission
(“FERC”) to impose mandatory electric reliability standards for the interstate electric
transmission system.

Dr Marija Ilic submits these comments as one of the most active academic researchers
in the field of electric power systems worldwide. Her views are her own and are not
submitted on behalf of any other institution or business that she may be affiliated with.

Dr Marija Ilic has been at MIT since 1987 as a Senior Research Scientist in the EECS Department where
she conducts research and teaches graduate courses in the area of electric power systems. Since September
1999 she has had a 50% appointment at the National Science Foundation as a Program Director for
Control, Networks and Computational Intelligence.

Prior to coming to MIT, she was a tenured faculty at the University of Illinois at Urbana-Champaign.
Dr Ilic is a recipient of the First Presidential Young Investigator Award for Power Systems, she is an IEEE
Fellow and an IEEE Distinguished Lecturer.

She has co-authored several books on the subject of large-scale electric power systems (Ilic, M., Zaborszky,
J., Dynamics and Control of Large Electric Power Systems, John Wiley & Sons, Inc., 2000; Ilic, M.,
Galiana, F., Fink, L. (Editors), Power Systems Restructuring: Engineering and Economics, Kluwer
Academic Publishers, Second printing 2000.; Allen, E., Ilic, M., Price-Based Commitment Decisions in
the Electricity Markets, Springer-Verlag London Limited, 1999; Ilic, M., Liu, S., Hierarchical Power
Systems Control: Its Value in a Changing Industry, Springer-Verlag London Limited, 1996). She is also a
contributor to the edited book on Blue Print for Transmission (PU Reports, 2000). Her interest is in
control and design of large-scale systems.

Executive Summary:

Dr Marija Ilic recommends that a very basic look be taken into the underlying paradigms
of reliability as the industry restructures. This should be done urgently and prior to
proceeding with any rulemaking and/or legislation regarding reliability of the US
Interconnected Grid. Once the first assessment is done, a carefully designed R&D
agenda for understanding the interplay of regulatory, economic and engineering
innovations should be established, possibly at the inter-agency level of several

government agencies. The questions raised can no longer be answered in a meaningful way without this major effort.

The industry is undergoing a fundamental change in operating the system as affected by the newly evolving technologies and/or the regulatory changes. Currently, there is a tremendous misfit between what the operating and planning practices and what might be possible under these changes. The deregulation has brought strong incentives (good or bad) to the old and new business entities. However, only a careful interplay of (partial) regulation, economic incentives (pricing of products and services) and the engineering/technical innovations could lead to the overall gain (social welfare over prolonged periods of time), while leaving enough room for decentralized decision making by various entities.

Possibly, the hardest connection to make concerns the relations between the market specifications (contracts for products and services in the new industry) and the traditional industry standards (operating and planning) developed under qualitatively different regulatory rules.

The most relevant change of paradigm has to do with how are various uncertainties presented when one operates and plans the system managed. It is absolutely fascinating to recognize that reliability-related risk management MUST go hand in hand with the contractual specifications for products/services in the new industry. Understanding this concept leads to the notion of RELIABILITY UNBUNDLING. The implications of this unbundling on business and quality of electricity service as seen by the customers are tremendous.

One could identify at least three qualitatively different sources of uncertainty as the industry is changing:

- A) Regulatory uncertainties
- B) Market designs
- C) Equipment status/functionality

Traditional reliability standards, the ones which DoE wishes to enforce into law, concern only C) for the assumed (old) A) and B)!!! It is at this point that it becomes clear that we would be going in circles for a very long time unless a very serious basic look into the paradigms of unbundled reliability under competition are established.

Here are a few key observations to support the fundamental problem in hand:

Observation 1: The (N-1) reliability standard must be replaced by a qualitatively different standard, see the attached [1].

Observation 2: Portion of electric service is likely to be bilateral, in which adequate supply is ensured through the contractual agreements between parties involved. The remaining users must be provided (as of now) by the providers of the last resort, that is

the remnants of the old utilities. This puts a tremendous burden on the providers of the last resort, since, with less profit to make on the supply side, they are expected to manage ALL uncertainties created by the market/regulation.

Observation 3: Instead, different entities must take on the reliability-related risks, not utilities only. This clearly implies unbundling of reliability contributions.

Observation 4: How are 1)—3) managed is very sensitive to the market design in place.

We suggest that Questions 1 through 8 raised by the DOE must be answered keeping these fundamental observations and qualitative changes in mind

In closing this summary, Dr Marija Ilic brings attention to the DOE to the recent strategic paper on a possible framework for electric technologies under deregulation prepared by two Program Directors at the National Science Foundation, Dr Marian Jelinek and myself [2]. This paper directly deals with the paradigm changes in providing electricity service under deregulation. She is attaching this paper in its present form. The paper was presented in December at the NSF Workshop concerning research needs in the electric power systems, and it will be posted at the NSF/ECS Division [www](http://www.nsf.gov) site as part of the Proceedings of this workshop by the end of January. Important to notice is the very end of this strategic paper, which makes suggestions for the role of the inter-agency activity in attempting the difficult situation in the electric power industry. Please observe that this strategic paper only expresses the views of the authors, and not necessarily of the NSF. We are in the process of active discussion of this material at the NSF. I personally offer my help with communication the ideas expressed in this strategic paper, and possibly having a joint meeting between the interested NSF and DOE staff. If there is any interest, Dr Marija Ilic would be glad to help organize such brainstorming session.

It is with the most sincere concerns for the industry's future that Dr Marija Ilic has offered these comments. As pointed out in [2], we are dealing with a much more difficult problem that it is broadly appreciated. R&D is barely trailing behind the problems as they present themselves. Many of these problems and decisions are likely to become more and more confusing unless serious effort is taken to have an open-minded look at the overall problems. Once again, university/government collaboration may be very critical in making progress on this subject.

Dr Marija Ilic does recognize that her comments deal with a longer-term strategy rather than immediate decisions. Nevertheless, the sooner the community starts engaging into the fundamental thinking about the problem, the sooner one may see some real progress. Instead, one may go through several regulatory mistakes without full understanding of the regulatory/rules making implications.

References:

- [1] **MARIJA D. ILIĆ , JOSÉ R. ARCE, YONG T. YOON**
ASSESSING RELIABILITY AS THE ELECTRIC POWER INDUSTRY RESTRUCTURES
MIT ENERGY LABORATORY WORKING PAPER NUMBER EL 00-007 WP, AUGUST 2000.
(also to appear in *The Electricity Journal*, March 2001.)
- [2] Marian Jelinek, Marija Ilic, A Strategic Framework for Electric Energy: Technology and Institutional Factors and IT in a Deregulated Industry, Proceedings of the NSF Workshop on Research Needs in Electric Power Systems, Arlington, VA December 2000.